



AIR SAMPLING FOR METALS [NIOSH Method 7300, Elements]

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1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to define the proper sample collection technique for air sampling for elements (metals), as well as delineate the typical working range of the method and indicate potential interferences. Elements covered by this method include the metals listed in Table 1 (Appendix A).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Air sampling for elements (metals) involves passing a known quantity of air across a mixed cellulose ester (MCE) filter. The particulate phase of the air, with a nominal size of greater than or equal to 0.8 microns (μm), is trapped in the filter.

This method requires air sampling utilizing 37 millimeter (mm), 3-stage cassettes loaded with 0.8 μm MCE filters and support pads. The approximate minimum and maximum sample volumes required for detection of the metals of interest are listed in Table 1 (Appendix A).

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

No preservatives or special storage conditions are required. However, the samples should be stored with

the filter upright and transported at or near ambient conditions to prevent significant deterioration of the samples. When transporting and handling the samples, prevent impact and vibrations which would dislodge particulates from the filters.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

A potential problem with the sampling method is over-loading of the filter. This can disrupt flow, consequently producing falsely low analytical results. Periodic checking of the filter and pump can predict this condition and sample cassettes can be changed during the sampling period. The multiple filters would be analyzed as one sample with the total volume indicated on the Chain of Custody record.

5.0 EQUIPMENT/APPARATUS

The following equipment is required for air sampling for elements:

- C Low or medium volume air pumps
- C Tygon tubing
- C 0.8 μm MCE filters with support pads
- C 37 mm 3-stage cassettes
- C Hose-barb filter adapters
- C Air flow calibration standard (calibrated rotameter or bubble meter)
- C Screw driver set
- C Air Sampling Worksheets and sample labels
- C Chain of Custody records
- C Particulate monitoring equipment (RAM)
- C Protective clothing
- C Whirl bags

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURE

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.
2. Obtain and organize the necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order. Precalibrate sampling equipment, if possible.
4. Prepare scheduling and coordinate with staff, client, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan.
6. Use stakes, flagging tape, or other appropriate means to mark all sampling locations. If necessary, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.
7. Make an estimate of the airborne concentrations of the elements of concern. It may be possible to extrapolate the concentration of particulates by assuming similar percentages of metals are present in the airborne particulates as in the soils. However, it should be noted that this is only a rough estimate. If estimation of the airborne concentration of metals is not possible, then sample volumes should remain within the limits recommended in Table 1 (Appendix A).
8. Arrange for sample analysis by an appropriately certified laboratory and check with the laboratory for any special requirements (e.g., additional lot blanks).

7.2 Calibration

Calibrate the required number of sampling pumps in the following manner:

1. Assemble the calibration train as shown in

Figure 1 (Appendix A) using a representative 37 mm, 3-stage filter cassette loaded with a 0.8 μm MCE filter and support pad (outlet plug removed), tygon tubing, a hose-barb filter adapter, a rotameter, and an air sampling pump. Depending on the required flow rate, a low volume or a medium volume sampling pump may be required. Refer to Figure 2 (Appendix A) for an illustration of the components of the filter cassette.

2. Turn on the pump and adjust the flow using the flow adjust mechanism until the float ball on the rotameter is aligned with the rotameter's precalibrated flow rate value. A sticker on the rotameter should indicate this value.
3. Affix a sticker to the pump indicating flow rate and media.

7.3 Sampling

1. Assemble the sampling trains with clean filter cassettes (Figures 3 and 4, Appendix A).
2. Verify the pump calibration by removing the inlet plug from the cassette, attaching a rotameter with Tygon tubing and turning on the sampling pump. Ensure that all connections are tight. Record the actual flow rate on the Air Sampling Worksheet. Replace the inlet plug until ready to sample.
3. Set the sampling pump timer (low volume pumps) for the appropriate sampling time as determined by the Work Assignment Manager, or record the elapsed timer readings (medium volume pumps) on the Air Sampling Worksheet. This will be dictated by the type of sampling pump being utilized.
4. Deploy the sampling pumps as indicated in the sampling plan, following site health and safety procedures.
5. Remove the cassette cap or inlet plug from the cassette. Sampling for elements can be conducted with the cassettes open-faced (cassette cap removed) or closed-faced (only inlet port plug removed). Open-faced is preferred because it permits an even loading of the filter cassette and should be used

whenever high particulate concentrations are expected. This allows greater particulate loading of the filter. However, either method is acceptable since the entire filter is used during sample analysis. Closed-faced sampling is typically performed when there is a possibility that the sample may be shaken and particulates may be lost.

6. Turn on the sampling pump and allow it to run for the sampling period determined by the Work Assignment Manager.

7.4 Post Sampling

1. Verify the sampling period by reading the sample run time (low volume pumps) or by checking the elapsed time on the counter (medium volume pumps). Record the sampling time on the Air Sampling Worksheet and turn off the pump.
2. Verify the pump calibration by attaching a rotameter with Tygon tubing and turning on the sampling pump. Record the actual flow rate on the Air Sampling Worksheet. Insert the inlet plug.
3. Remove the sampling cassette from the sampling train and insert the outlet plug.
4. Complete the Air Sampling Worksheet and calculate the sample volume.
5. Label the sample and place it in a whirl bag for transport to the laboratory for analysis.
6. Prepare the samples (including QC samples) for transport by packing them in a shipping container with bubble wrap or styrofoam pieces. Complete a Chain of Custody record in accordance with applicable Chain of Custody Procedures.

8.0 CALCULATIONS

The total volume of a sample is calculated by multiplying the total sample time by the flow rate. The total volume for each sample must be indicated on the Chain of Custody Record.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general QA procedures apply:

1. All data must be documented on Air Sampling Worksheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

The following specific QC activities apply:

1. Provide one field blank per sampling event or per 20 samples, whichever is greater. The field blank should be handled in the same manner as the sampling cassette (remove/replace cap and plug, and transport) except that no air is drawn through it.
2. Collect one collocated sample per sampling event or per 10 samples, whichever is greater. Collocated samples are two samples collected adjacent to each other during the same time period at the same flow rates.
3. Include a minimum of two lot blanks per manufacturer's lot of sampling cassettes utilized per sampling event. Consult with the analytical laboratory to determine if additional lot blanks are required.

10.0 DATA VALIDATION

Results of the QA/QC samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results accordingly with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, or corporate health and safety procedures.

12.0 REFERENCES

⁽¹⁾NIOSH Manual of Analytical Methods, NIOSH Method 7300, Elements (ICP) (Issued 02/15/84).

APPENDIX A

Table

TABLE 1. Metal Concentrations are Anticipated to be at or Near
the Threshold Limit Value (TLV)

Element (Symbol)	Minimum Air Volume to be collected - Liters	Maximum Air Volume to be collected - Liters
Silver (Ag)	250	2000
Aluminum (Al)	5 ⁽¹⁾	100 ⁽¹⁾
Arsenic (As)	5	2000
Beryllium (Be)	1250	2000
Calcium (Ca)	5	200
Cadmium (Cd)	13	2000
Cobalt (Co)	25	2000
Chromium (Cr)	5	1000
Copper (Cu)	5	1000
Iron (Fe)	5	100
Lithium (Li)	100	2000
Magnesium (Mg)	5	67
Manganese (Mn)	5	200
Molybdenum (Mo)	5	67
Sodium (Na)	13	2000
Nickel (Ni)	5	1000
Phosphorus (P)	25 ⁽¹⁾	2000 ⁽¹⁾
Lead (Pb)	50	2000
Platinum (Pt)	1250	2000
Selenium (Se)	13	2000
Tin (Sn)	5	500
Tellurium (Te)	25	2000
Titanium (Ti)	5	100
Thallium (Tl)	25	2000
Vanadium (V)	5	2000
Tungsten (W)	5 ⁽¹⁾	200 ⁽¹⁾
Yttrium (Y)	5	1000
Zinc (Zn)	5	200
Zirconium (Zr)	5	200

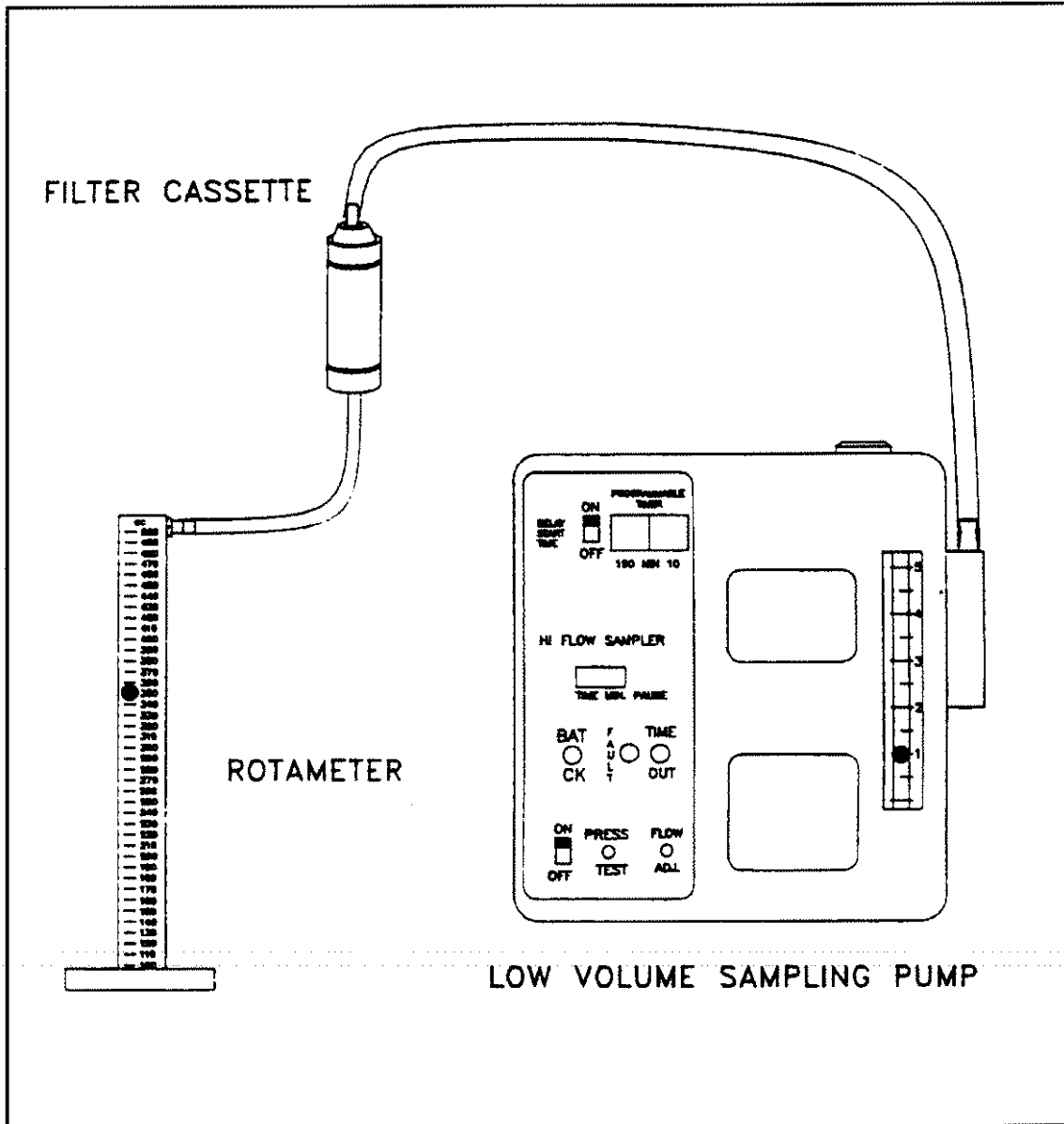
NOTE: Do not exceed a filter loading of approximately 2mg total dust.

⁽¹⁾ Greater volumes may be required if the anticipated concentration is less than the ACGIH TLV.

APPENDIX B

Figures

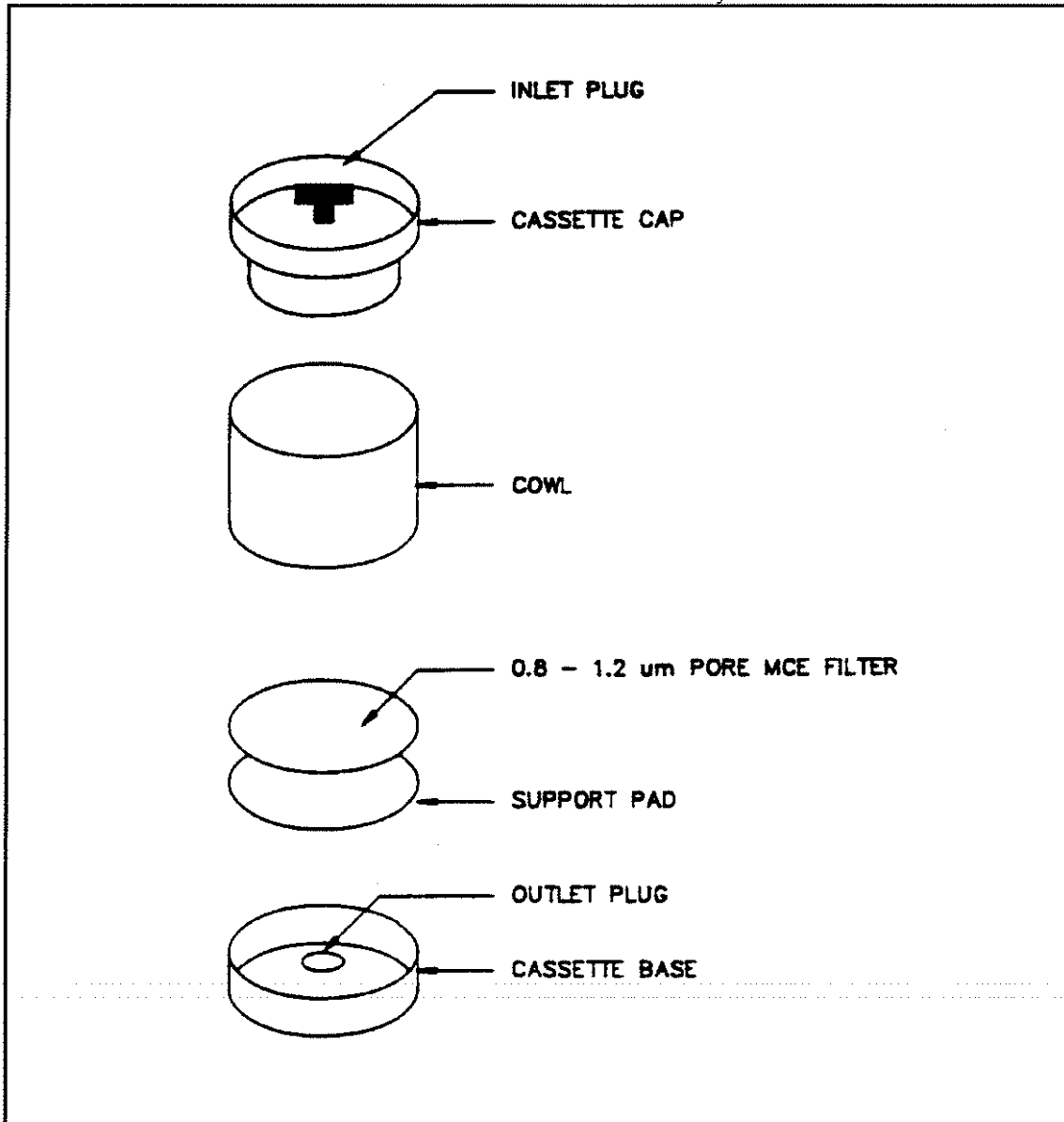
FIGURE 1. Calibration Train with Low Volume Sampling Pump



APPENDIX B (Cont'd)

Figures

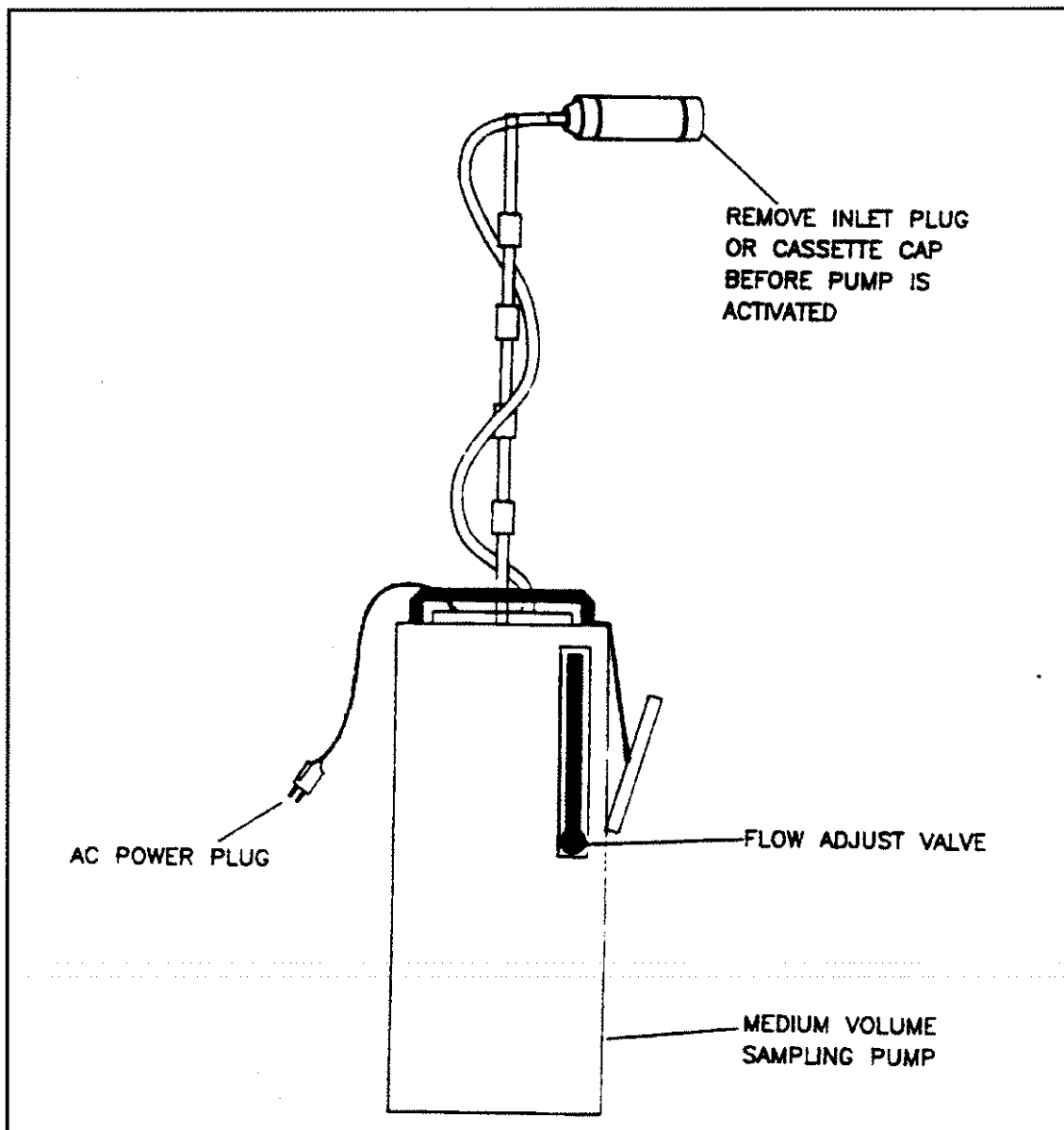
FIGURE 2. Filter Cassette Assembly



APPENDIX B (Cont'd)

Figures

FIGURE 3. Medium Volume Sampling Train



APPENDIX B (Cont'd)

Figures

FIGURE 4. Sampling Train with Low Volume Sampling Pump

